SAFETY HARNESS

BACKGROUND OF INVENTION

The invention relates to a safety harness for use in industrial and recreational environments, and in particular to a safety harness that absorbs a shock when a person wearing the harness falls from an elevated structure.

Many industries require the use of a harness when the worker is employed on an elevated structure, such as scaffolding, oil rig, pipelines, construction sites and the like. The harness is connected to a lanyard, one end of which is fastened to the harness and the other end to a stable structure, such as a scaffold. Each harness must meet set requirements designed for protecting the workers in case of a fall. For example, one of the requirements is that the harness support 1800 pounds of weight, taking into account the speed of the fall from the elevated position.

Conventional harnesses include at least a belt which encircles the torso of the user and shoulder straps that cross in the back, wherein a D-ring or other similar lanyard attachment member is positioned. The harness straps are conventionally made of nylon webbing or leather; these straps do not stretch and have negligible resiliency. Conventional lanyards are made of cords or ropes; they are also non-resilient, providing little shock-absorbing qualities to the harness.

When a user falls and the lanyard reaches its outermost extension, the speed of decent is sharply interrupted. The shock of the abrupt interruption applies a considerable pressure on the bone structure and internal organs of the user. Another disadvantage attributable to conventional harnesses is positioning of the lanyard in the back of the harness, usually close to the waistline of the user's back. When the user falls, he usually descends with his face down; dangling in the harness, suspended by the lanyard in a position that imposes considerable pressure on the user's

abdomen. The almost horizontal position is also dangerous because the user may accidentally hit the adjoining structure, such as the wall of the building or the scaffolding, causing injury to the head or the limbs.

The industry has attempted to solve this problem by providing improvements to industrial harnesses, one of which is disclosed in U. S. Patent No. 5,487,444 issued on January 30, 1996. In that patent, the safety harness includes a resilient, elastomeric cord assembly connected to the backside of the harness and the end portion of the harness. The two portions of the cord assembly connect to a safety fail-safe lanyard. The cord and the lanyard create a three-point support system to absorb the shock of the fall and help retain the person in an upright position. The fail-safe lanyard acts as a back up in case of a failure of the elastomeric cord assembly. The lanyard and the fail-safe lanyard are made from a non-stretchable material.

While the safety harness in accordance with the '444 patent is an improvement over prior safety harnesses, there is still room for improvement, particularly in the area of shock-absorption. The present invention contemplates provision of a safety harness with enhanced shock-absorbing capabilities.

SUMMARY OF THE INVENTION

It is, therefore, an object of the present invention to provide a safety harness that is suitable for use in industrial and recreational environments.

It is another object of the present invention to provide a shock absorbing safety harness that is constructed as one unit.

It is a further object of the present invention to provide a shock absorbing safety harness that is lightweight, comfortable to use, while being strong and reliable.

It is still a further object of the present invention to provide a safety harness with improved shock-absorbing properties.

These and other objects of the present invention are achieved through a provision of a safety harness that comprises a body harness assembly and a stretchable shock-absorbing suspender assembly that is fixedly attached to the body harness. In one of the embodiments, shoulder straps of the body harness are provided with stretchable inserts at the apexes of the straps to increase shock-absorption during an accidental fall. The shoulder straps are attached to a waist strap or extend below the waist strap to a pair of leg, or thigh straps.

Optional features include provision of padded inserts at the shoulder and waist straps to increase shock absorption and make the harness more comfortable for the user. All straps are provided with adjustable buckles or other types of closing members to allow for snug fit of the harness on the user's torso.

Another embodiment of the invention provides for a built-in harness combined with a floatation vest or hunting vest. In this embodiment, the body harness is sewn into the vest structure, protecting the user's body from heavy impact of the straps in case of accidental falls. In still another embodiment, the body harness assembly is sewn into a hunting jacket or a jumpsuit, providing an additional "padding" interposed between the user's body and the harness straps.

BRIEF DESCRIPTION OF THE DRAWINGS

Reference will not be made to the drawings wherein like parts are designated by like numerals and wherein Figure 1 is a perspective view of the safety harness in accordance with the present invention showing a user suspended by a lanyard.

Figure 2 is a perspective view of the safety harness in accordance with the present invention as worn by a user during normal activities.

Figure 3 is a front view of the first embodiment of the safety harness in accordance with the present invention.

Figure 4 is a side view of the first embodiment of the safety harness.

Figure 5 is a back view of the first embodiment of the safety harness.

Figure 6 is a front view of the first embodiment of the safety harness with an addition of an elastomeric shock absorber assembly.

Figure 7 is a back view of the safety harness with the elastomeric shock absorber.

Figure 8 is a front view of the second embodiment of the present invention with an optional seat belt and padded straps.

Figure 9 is a detail view showing a back up lanyard used with a safety harness of the present invention.

Figure 10 is a detail view of a mating buckle for use on breast strap and leg straps of the safety harness.

Figure 11 is a detail view showing a friction buckle that can be used with shoulder straps of the safety harness.

Figure 12 is a detail view illustrating attachment of the hardware to the web straps of the safety harness.

Figure 13 is a detail view illustrating a grommet buckle that can be used on leg straps or belt straps of the safety harness.

Figure 14 is a detail view illustrating optional leg pads for leg straps.

Figure 15 is a detail view illustrating shoulder pad inserts.

Figure 16 is a detail view illustrating an optional chest strap with a D-ring.

Figure 17 is a perspective view of the second embodiment of the present invention, wherein the safety harness is fixedly attached to a floatation vest.

Figure 18 is a detailed view of the third embodiment of the safety harness wherein the harness is securely attached to a jumpsuit or a jacket of the user.

DETAIL DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings in more detail, numeral 10 designates the shock absorbing safety harness in accordance with the present invention. The safety harness 10 comprises a body harness 12 adapted for positioning on the user's torso, a shock absorbing suspender assembly 14 and a lanyard assembly 16.

The body harness 12 has a front side 20 and a backside 22. The body harness 12 comprises a pair of shoulder straps 24 and 26, a belt 28, and a pair of leg straps 30 and 32. The shoulder straps 24 and 26 are provided with adjustable buckles 34 and 36, foe example grommet buckles shown in more detail in Figure 13, to allow adjustment of the length of the straps 24 and 26 depending on the user's size. The shoulder straps 24 and 26 terminate at the belt 28, where each strap 24, 26 forms a loop that is sewn to the waist strap, or belt 28, as shown in Figures 3-5.

The right shoulder strap 24 and the left shoulder strap 26 extend over the shoulders of the user and cross in the back, at the junction designated by numerals 38 in the drawings, wherein a reinforcing tab is stitched to the underside of both shoulder straps. A D-ring 40, shown in more detail in Figure 5, secures the shoulder straps together and forms a receiving member for a lanyard, as will be described in more detail hereinafter.

At least a portion of the shoulder straps 24 and 26 is formed from an elastomeric resilient material. The resilient portions are designed numerals 40 and 42 in Figures 3-5. The remainder of the shoulder straps can be formed from nylon webbing, leather, and other similar non-

stretchable material. The elastomeric portions 40 and 42 provide more comfortable positioning on the user's body and increase the shock-absorbing properties of the safety harness 10.

After crossing in the back at the junction 38, the shoulder straps 24 and 26 continue to the belt 28, wherein the straps are folded and stitched to the belt as shown at 44 and 46 in Figure 5. The shoulder straps then extend below the belt 28 and become thigh, or leg straps 30 and 32, forming loops for receiving legs of the user. At the front, the leg straps 30 and 32 are provided with adjustment members 48 and 50, respectively.

The adjustment members 48 and 50 can be in the form of mating buckles, shown in detail in Figure 10, or friction buckles shown in Figure 11. By pulling the free ends 52 and 54, the user can adjust the length of the loops formed by the leg straps 30 and 32 to snugly encircle the legs or thighs of the user. The leg straps 30 and 32 are sewn to the belt strap 28, as designated by numerals 56 and 58 in Figure 4. The leg straps 30 and 32 are formed from a non-stretchable, flexible webbing, similar to the main portions of the shoulder straps 24 and 26.

The belt 28 has an adjustment buckle 60 which may be a grommet buckle, similar to the buckles 34 and 36, to allow adjustment of the belt strap depending on the torso circumference of the user. When in use, the harness can secure the user's shoulders, thighs, and mid-section. The elastomeric shoulder portions 40 and 42 stretch under the gravity force, while transmitting the load to the waist strap 28, thus decreasing the shock imposed by the fall on the user's body.

Turning now to the embodiment of Figures 6 and 7, a safety harness 60 is shown to comprise a body harness 62 and the resilient elastomeric shock-absorbing suspender assembly 14. The suspender assembly 14 may be used with any embodiment of the present invention. The body harness 62, similarly to the harness 10, comprises a pair of shoulder straps 64 and 66, a pair of leg straps 68 and 70, and a waist strap 72. The shoulder straps 64 and 66, in this embodiment,

are not sewn to the belt 72, as can be seen in Figures 6 and 7. Instead, the front portions of the shoulder straps 64,66 extend below the belt strap 72 and attach to the leg straps 68 and 70.

The back side portions of the shoulder straps 64 and 66, designated by numerals 74 and 76 in the drawings, reach a cross point 78, wherein they are connected by a reinforcing patch or tab 80 and, having crossed each other, extend downwardly toward the belt strap 72 and further toward the leg straps 68 and 70. The shoulder straps portions 74 and 76 are looped over the leg straps 68 and 70 and are sewn at portions 84, 86 to the leg straps 70 and 68, respectively (Figure 7). The cross point of the shoulder strap portions 74 and 76 carries a D-ring 88, through a lower opening of which the shoulder straps 64,66 pass.

Fixedly attached to the shoulder straps 64 and 66 is a suspender assembly 14. The suspender assembly 14 comprises elastic resilient cords, or bands 90 and 92 which are fixedly attached, such as by stitching, to a respective shoulder strap portion at points 94,96 below the apex of the shoulder straps, as shown in Figure 6. The elastic cords 90 and 92 pass through a ring 98 and are then attached, such as by sewing, to the D-ring 88, as shown in Figure 7. The elastic cords 90 and 92 pass through an opening 100 in the D-ring 88, then are folded over and stitched across, thus fixedly securely attaching the elastic cords 90 and 92 to the D-ring 88.

Friction buckles 102 and 104 that are positioned at the front side of the shoulder straps 64,66 allow adjustment of the length of the shoulder straps. The belt 72 carries a grommet buckle 106, while the leg strap 68 and 70 may be provided with similar grommet buckles 108 and 110 or other suitable closing means. A ring 98 serves as a means for attaching a lanyard to the harness 60 as will be described below.

The shoulder straps 64 and 66 are made from nylon webbing, for example two inch wide and having a 5000 tensile strength. If desired, the harness 60 may be provided with stretchable

inserts in the shoulder straps 64 and 68 adjacent the apex of the shoulder straps, similarly to the harness assembly 10 to increase shock-absorbing characteristics of the safety harness 60.

Referring to Figure 8, a safety harness 120 of the present invention is illustrated with a number of optional features. The safety harness 120 comprises a pair of shoulder straps 122 and 124; a breast strap 126, a pair of leg straps 128 and 130, a waist strap 132, and a seat belt 134. The shoulder straps 122 and 124 cross in the back and are inserted through a D-ring 156, after which they descend downwardly to be securely attached to the waist strap 132. The shoulder straps 122 and 124 are each provided with shoulder pads 136 and 138, that are positioned near the apex of the shoulder straps to soften the contact between the shoulder straps and the body of the user.

Each shoulder pad 136, 138 is provided with soft, compressible lining 140 on the interior side and with two or more loops 142 and 144 on the exterior surface thereof. The loops 142 and 144 receive the shoulder straps 122 and 124 therethrough to thereby secure the pads 136, 138 in relation to the shoulder straps. By sliding the pad inserts 136, 138 forward or backward, the user can adjust position of the pads 136 and 138 to a more comfortable place on the shoulder, thereby preventing "digging" of the straps 122 and 124 into the shoulders in case of an accidental fall.

The breast strap 126 is positioned between the straps 122 and 124, in a sliding relationship thereto, in the area of the upper torso of the user. The breast strap 126 is provided with loops that allow slideable movement of the breast strap 126 up or down along the straps 122 and 124 to the most comfortable position. One or more friction buckles 146 are secured to the breast strap 126 to facilitate tightening of the strap 126 on the user's body.

The waist strap 132 is provided with an interior pad 150 secured on the posterior portion of the belt strap 132. The pad 150 can be four inches wide and provide an extra protection to the

back of the user wearing the harness 120. One or more D-rings 152 may be placed on the belt strap 132 for work applications, if necessary. A grommet buckle 154 is provided at the front of the belt strap 132 for tightening of the belt above the waist of the user.

The seat belt 134 is secured to the waist strap 132 to support the user's seat when the harness 120 is in use. The seat belt 134 allows better distributing the forces acting on the leg straps 128, 130, and preventing pulling of the user's thigh muscles during an accidental fall.

Referring now to Figure 9, the lanyard 61 is shown to comprise a pair of bands 160 and 162, each carrying a locking snap hook 164 and 166, respectively, at first ends thereof. The opposite ends of the bands 160 and 162 are joined together, such as by sewing at 168 and then attached to the second locking snap hook 172. The locking snap hook 172 hooks on the ring 98 on the shock-absorbing suspender assembly 14.

A secondary lanyard 176, made from non-stretchable webbing, is attached at one of its ends to the ring 174, and to a D-ring 100 on the suspender assembly 14. The fail-safe secondary lanyard 176 prevents excessive stretching of the shock-absorbing cords during a fall and limits the length, to which the cords are stretched. The length of the secondary lanyard 176 is longer than the length of the portion 178 of the cord assembly 14. While the cord assembly stretches, the portion 178 will be limited in its extension by the length of the secondary lanyard 176.

Alternatively, the lanyard 16 may be sewn directly to the ring 174 and to the D-ring 100, eliminating the second locking snap hook 172. Such arrangement is expected to simplify the manufacture of the safety harness and remove one of the mechanical elements that may fail during a fall.

Figure 10 illustrates a detail of a mating buckle that may be used on a breast strap 126 or the leg straps 128 and 130. The mating buckle 146 is of conventional construction; it is shown

for the purpose of illustration and not in a limiting sense. Figure 11 illustrates a friction buckle, for example buckle 104 that may be used with the safety harness 60.

Figure 12 illustrates in detail the manner of attaching the webbing of the strap to the harness hardware, here a D-ring. As can be seen in Figure 12, the end of the strap 180 is folded through an opening 182 and then stitched to the main body 184 of the strap thereby fixedly attaching the strap 184 to a piece of hardware.

Figure 13 illustrates a conventional grommet buckle that may be used for shoulder straps, waist straps, and other strap components of the safety harness, wherein a more precise adjustment to a comfortable length is required. Figure 14 illustrates in more detail an optional pad 184 provided on a leg strap, for example a leg strap 128. Figure 15 illustrates in more detail the shoulder strap 136, while Figure 16 illustrates an optional D-ring positioned on a chest strap 126. The optional D-rings may be used for securing of tools or other harness elements, if necessary.

Referring now to the embodiment shown in Figure 17, a safety harness 190 is seen attached, or built-in, into to a floatation vest 192. In this embodiment, the shoulder straps 194 and 196 are fixedly attached or sewn to the vest, forming a unitary article of clothing provided with safety features. The shoulder straps 194 and 196 are sewn to the front of the vest 192 at 198 and 200.

The straps 194 and 196 are similarly secured to the back of the vest (not shown) at a location that is about opposite to the stitched areas 198, 200. As with the previously discussed safety harnesses, the harness 190 is provided with a D-ring (not shown) on the back of the vest to which a lanyard can be secured. The straps 194 and 196 are each provided with an adjustment buckle, for example a friction buckle 202 on the front of the vest. The straps 194, 196 terminate

at the waist strap 204, to which they may be fastened by a sliding ring 206 or simply sewn directly to the waist strap 204.

The waist strap 204 encircles the waist area of the vest. The belt 204 is fixedly attached, along the majority of its length, to the vest 192, leaving the forward most portions 208 and 210, which are used for adjusting the circumference of the waist belt 204 on the user's body. A grommet buckle 212 is provided for use between the portions 208 and 210. If desired, one or more D-rings 214 are suspended from the waist belt 204 for tool applications, although the D-rings 214 are optional.

A breast strap 216 is slideably engageable with shoulder straps 194 and 196. The breast strap 216 moves up and down in relation to the straps 194 and 196 to a position most comfortable to the user. A friction buckle 218 may be provided for closing the breast strap 216 after the vest has been donned on the user. The vest 192 is preferably provided with a front closure, such as a zipper 220 extending along the length of the front portion of the vest, as shown in Figure 17.

It is envisioned that the vest 192 may be used for recreational purposes, for example during hunting, where the user secures the harness to the tree or to a flotation vest, where the user secures the harness to a boat or other marine vessel. In case of an accidental fall from a tree, the vest 192 with the built-in harness 190 will provide a restraining line, breaking the fall before the user hits the ground, while absorbing the shock of the fall and distributing it through the harness members. When used as a floatation vest, the device 192 will restrain the distance, to which the user may travel from a boat, securing the user if he/she happens to fall overboard.

Figure 18 illustrates an embodiment of the present invention, wherein a safety harness 230 is incorporated with a jump suit or jacket 232. The jacket 232 covers at least the upper torso

of the user and, similarly to the vest 190, has a built in harness 230. The harness 230 has a pair of shoulder straps 234 and 236 that are stitched are sewn to the front of the jacket at 238 and 240 and at opposing positions in the posterior side of the jacket. The shoulder straps extend downwardly below the waist strap 242 and attach to the leg or thigh straps 244 and 246.

The shoulder straps 234, 236 similarly attach to the back of the leg straps 244, 246 in the back of the jacket (not shown) by stitching or by other similar means. The straps 242, 244, and 246 are fixedly attached, along major portions of the lengths thereof, to the jacket 232, or to a jump suit as the case might be. In the alternative, the leg straps 244 and 246 may remain unattached, being secured only to the shoulder straps 234 and 236.

A breast strap 248 is secured in a sliding relationship to the shoulder straps 234 and 236 to allow vertical adjustment in the position of the breast strap on the user's body. Each of the straps 234, 236, 242, 244, 246, and 248 is provided with a length adjustment means, such as a friction buckle, grommet buckle and the like, depending on the manufacturer's selection. If desired, optional D-rings 250 may be provided on the waist strap 242.

It is envisioned that the article of clothing 232 will find its use with safety jackets, hunting jackets, hunting jumpsuits, or other similar. The body harness 230, similar to the safety harnesses discussed above, is provided with a D-ring in the back (not shown) to which a elastomeric resilient suspender assembly 14 is secured.

The safety harness of the present invention is designed to comply with and exceed the standards of the American National Standards Institute for safety. The harness hardware, that is the buckles and rings of the safety harness may be manufactured from steel or from lightweight plastic, so as to make the safety harness more comfortable to use.

The hunting vest and the hunting jacket may be manufactured from camouflage-patterned fabric to make it more attractive during hunting. It is also envisioned that the straps may have a camouflage-patterned coating on the exterior surfaces thereof that duplicate the camouflage pattern of the hunting attire to make the user less visible outdoors.

The harness uses a 2 inch by 16 inch fine weave nylon webbing having up to 6,000 pounds tensile strength for each strap. The waist strap may be double layered to allow for tool pouches or other slide-on attachments. To make the connection points more secure, a multi pass "box-x" stitch pattern is used at connection points of the harness straps.

The lanyard, along almost its entire length can be made from 1 inch by 1/16 inch fine weave nylon webbing designed to provide increased resistance to impact under load. The load is expected not to exceed 1500 pounds. Each layer of lanyard webbing has a minimum of 3600 pounds tensile strength, with a total of 7200 pounds for double lanyard.

The lanyard may be sewn directly to the D-ring of the harness or it may be detachable with a snap hook attachment. It can be removed at the factory for replacement if worn out or cracked. The tie off/anchor of the lanyard has a locking keeper snap hook. It is preferred that he tie off location is parallel to or above the height where the D-ring of the harness is positioned. The tie off location above the D-ring is expected to reduce the fall distance.

The three-point connection of the shock-absorbing resilient assembly significantly reduces the impact force of the fall and swing. The user remains in a vertical position, as shown in Figure 1, when suspended by the lanyard. The resilient material integrated with the harness shoulders allows for slower deceleration without extension of the lanyard length during fall.

Many changes and modifications can be made in the design of the present invention without departing from the spirit thereof. I, therefore, pray that my rights to the present invention be limited only by the scope of the appended claims.